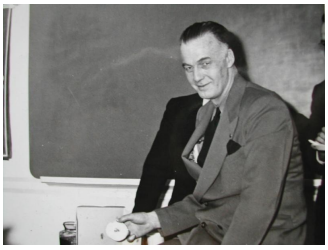

ENEMY OF THE BOURGEOISIE
(his own preferred epithet)

An Authentic American Radical

- William Sheridan -

http://bat8.inria.fr/~lang/hotlist/free/licence/information/radical.htm

Howard Scott was born in West Virginia on the 1st of April, 1890, the only child of a 19th century American logging baron. He was a child prodigy who read (and understood) evolutionary biology by the time he was four years old. As well as a prodigious intellect, he had a marvelous physique, and by the time he attended the state university in West Virginia, his six foot frame made him as adept at football as engineering. He kicked the longest punt in the university's history, and to his chagrin was more hailed for that feat than his academic record. His father's untimely death cut short his university education, and he became a practicing engineer.

The predominant intellectual influence on Scott was J. Willard Gibbs (1839 - 1903), the Yale Professor of Mathematical Physics. Although he never had the opportunity to meet Gibbs, he did get to know most of Gibbs' students. He read all of Gibbs work, and mastered the innovative mathematical technique that Gibbs pioneered to represent the thermodynamics of phase changes in physical chemistry, namely linear vector analysis. Scott has the cognitive capacity to mentally calculate linear vector analysis with six factors, an ability that made him one in a billion.

The life's work that he set for himself was to develop "a science of geomechanics, for the operation of large areas of the earth's surface both beneath and above". With the use of linear vector analysis, he developed The Mathematical Theory of Energy Determinants as a tool to describe the entire industrial ecology of the North American continent. To earn an income he worked as a consulting engineer on New York State high-voltage transmission research, and as a construction technologist on the Muscle Shoals Power Plant on the Tennessee River, etc.

An Early Think Tank

Just after the end of World War 1, he formed one of America's first think tanks, The Technical Alliance, in association with such notable men of science as Charles P. Steinmetz, Richard C. Tolman, and Bassett Jones. As executive director of the Technical Alliance, Scott defined the group's mandate as the conduct of "The Energy Survey of North America".

The premise of Scott's thinking was that anything that functions performs as an "energy consuming device". This definition covered everything from geophysical systems, through ecological systems, organisms, populations, tools and machines. What needed to be determined in each case, was the device's rate of extraneous energy consumption, and its efficiency of converting that energy into work. As an engineer, Scott defined waste as any process which sub-optimized on its efficiency of energy conversion.

He argued that just like a steam engine, a social system's use of energy could be assessed in terms of efficiency. His postulate for this claim was that "the phenomena involved in the functional operation of a social system are metrical". Applying his Mathematical Theory of Energy Determinants to the data from the Energy Survey of North America, he could easily demonstrate that society was squandering resources, wasting energy, and degrading the ecosystem.

The Engineer's Paradigm

Using linear vector analysis, he also developed a calculus and modulus of design that enabled him to propose optimized solutions for all industrial functions. He conceived of fully automated factories, integrated transportation, communications, and electrical transmission networks, and product life cycle planning in the 1920s.

All of the Technical Alliance members contributed their different expertise to the research on The Energy Survey of North America. Other luminaries that Scott befriended, such as Nikola Tesla and Thorstein Veblen, were also eager to contribute their thinking to the project. Through his numerous contacts in industrial and government circles, Scott gained access to such data as the resource inventories assembled by the Commission of Conservation (Canada), and the Geological Survey, Forest Service, and Bureau of Reclamation (United States).

What Scott discovered was, that during the geological history of the continent, particularly in the aftermath of the glaciation of the Pleistocene period, water run-off cut glacial troughs between most of the drainage basins of the major rivers. After most of the ice was gone and the watersheds regained their previous patterns, the glacial troughs remained. Scott conceived of a plan to locate dams at strategic junctures, reflood the old glacial troughs, and re-link all the major rivers into an integrated inland waterway for the entire continent. Water transport would be possible from the Gulf of Mexico to the Mackenzie delta, from St. John's, Newfoundland to Seattle, Washington.

Continental Hydrology

According to The Energy Survey of North America, water transport of bulk commodities could be accomplished for 1/10th the energy cost of rail or road modes. So besides harnessing most of the major hydro-electric sites on the Continent, the cost of transportation could be dramatically reduced. Scott designed "marine trains" to ply these waterways, with diesel-electric tractor units for power, and electrical couplings to the bulk-carrier units. To negotiate the differences in elevation at the dam sites, he designed hydraulic lift locks that could raise upwards to 400 feet in a few minutes.

To satisfy the widespread demand for electrical power, Scott designed a 1-million volt, DC power line. His research indicated that for these specs, power could be transmitted over distances of 5,000 miles with only a 10% power loss, whereas AC lines lost 10% over only 500 miles. He proposed a Continental Power Grid that would link all the major sources of electric power, and shift electricity across time zones so that local areas would not have to over-install to meet peak-load demands. Instead power would be shifted from areas of light use to those of heavy use, and stepped down to usable voltages and AC for local distribution.

Scott's designs for railways were also far more efficient than conventional models. He proposed to widen the gauge to 3 meters, install a gimbal suspension system, and reduce clearance between the cars and the tracks to six inches. With this lower center of gravity and adjustable suspension, speeds could then be safely increased to 200 miles an hour. The indented space between the tracks could be infilled with concrete sections that would be flush with the heights of the tracks, creating minimum aerodynamic resistance beneath the train.

Other High-Tech Solutions

Inter-state and inter-city highways were also redesigned. A cable buried up the center of each traffic lane could control the steering and speed of each vehicle. Steering would work on a "homing" device, and vehicle speed could be controlled by the rate of current in the cable. Special metering telemetry posts would be located every few hundred yards along the highway, to monitor for changes in weather conditions or traffic mishaps, and corrective action could be taken at central control.

Pollution would be prevented by recycling all forms of waste. With his knowledge of chemical engineering, Scott designed numerous reclamation techniques. Sewage would be fermented to produce methane gas, and that could heat most of the buildings of the continent. The sewage residue could be processed into plastics. All other forms of industrial and domestic waste could be just as effectively reused, so that all human resource consumption would become closed loops.

Airplane design also got the efficiency treatment. Large planes of conventional design have fuselages which exert drag but have no lift capacity. Instead, Scott designed a flying wing. The whole body of the aircraft would be a wing structure, so that its entire bottom surface would provide lift. This aircraft has a gliding ration of eleven to one, so that it has a range which is eleven times the distance of its altitude. That would give an onboard machine shop time to fabricate any part for replacement BEFORE the aircraft came down! The reason other flying wing designs were unstable was that their wing flaps were not wide enough in proportion to the breadth of the wing, but Scott's design did have the correct proportions for flight stability.

Machines To Live In

When The Energy Survey of North America looked at the performance of cities, the results were astounding. Scott estimated that existing buildings were so wasteful of energy, that the entire cost of tearing them down and reconstructing them all to adequate efficiency standards, would be recovered in just twenty years of operations. Instead of bungalows and suburbs that waste materials, energy, and land, he proposed mega-structures with optimum densities and economies of scale for all services.

Whenever feasible, these living units would be located along the waterways of the Continental Hydrology. That way the cities could be serviced in terms of both ingress of resources and egress of manufactured products on the waterways. Leisure and educational travel would also be facilitated by the Continental Hydrology, so hospitality accommodations would occupy a proportion of all these new cities, just as they do at present.

The mega-structure units were designed to be build of concrete, forty stories high, with facilities centralized whenever that arrangement would enhance efficiencies. Individual apartments would be enclosed by movable curtain walls of "foam concrete", so that plans could include everything from single-occupant to extended-family arrangements. Cafeterias, educational environments, recreational areas, and manufacturing, shipment and storage facilities, would all be made available as the particular population at that site required them.

A New Design For Living

What I have surveyed are just some of the major features of Scott's social and industrial design. Virtually every energy-consuming process in North America was evaluated for its energy efficiency, and found wanting. A new design was therefore proposed that optimized resource use and energy efficiency. All of this would require that the economy also be revamped. Income

would be in energy credits, with a continuous continental accounting system to track the production and distribution of every product. Such instantaneous feedback would permit output to be matched to demand, with no more over-production or under-consumption.

After completing The Energy Survey of North America, Scott concluded that neither business nor political methods could effectively administer a high-energy society. During the depths of the Great Depression, he raised a storm of controversy by claiming that low cost kilo-watt hours were replacing higher cost man-hours to such an extent, that gainful employment, income distribution, and the industrial economy itself, were all in jeopardy. So he proposed a Technate, a technological government for the entire continent, that would operate a collective human lifestyle so that we would live within our environmental and industrial limits. No more waste of resources, energy, or living space. And he predicted that technological progression would push North Americans to a forced-choice crisis, when they must either install a Technate or face the collapse of their entire social system. But despite his attempts to mobilize public support for what he claimed was "the next most probable state of society on this Continent", he could never persuade more than a small minority.

Many of his designs were so advanced, that even now they seem revolutionary. Yet his concepts have been proven feasible when sufficient research and development were forthcoming. Howard Scott died in 1970, and today his plans have virtually disappeared from the public agenda. Why did the most advanced proposal for industrial and social restructuring on this continent fade so completely from public consciousness? The answer is simple yet devastating. Like Plato in ancient Greece, Scott railed against incompetence and waste, but the public still prefers its complacent existence to the strictures of regimented virtuosity.

The Limits Of Efficiency

Scott's plan was an engineering masterpiece as well as a paragon of responsible environmental management. But it was not congenial to business and political elites, and it was advanced far beyond what the average mentality could comprehend or accept. Scott advocated that people adapt to the requirements of the machine, but most people couldn't get too enthusiastic about that prospect. His plan was first publicized over 60 years ago, but the public seems no more ready to adopt anything like that now than they were then.

But there is an even deeper problem with Scott's plan than a lack of public enthusiasm. As Marshall McLuhan has only recently shown us, technology has four types of effects on us, and the most troubling of these is the Reversal Effect. What the Reversal Effect shows, is that even a worthwhile innovation (like the concept of efficiency) can be over-used, with the result that the original benefits are eventually offset by accumulating detriments. To his close collaborators, Scott conceded that the implementation of his plan would amount to "a dictatorship of science". Science however, cannot provide the social or personal values upon which either social solidarity or personal fulfillment depend, yet without these attributes no culture can survive.

But there are some ironies in recent technological trends. High-voltage direct-current electrical transmission lines are now in use. Flying-wing aircraft are under development. Computerized highways are on the drawing board. Satellites now make the monitoring and control of continental ecology a real possibility. Bar codes and point-of-sales scanners are being increasingly used for continuous, company-wide inventory management. Although his larger social visions has been rejected, many of Scott's predictions about the direction of design continue to be confirmed. So how do we assess his contribution?

A New Thermodynamics

The place to start is to recognize the cultural context of Scott's thinking. His plans, as well as all of the science and technology on which they are based, consists of information rather than energy. Facts, theories, and designs, are all symbolic constructions -- so the basis of social process improvement and innovation is NOT thermodynamics but cybernetics!

Even the thermodynamics itself on which Scott's designs were premised, is now obsolete. The Mathematical Theory of Energy Determinants was inspired by Gibbs' last published work. In that book [Statistical Mechanics], Gibbs modeled closed systems, and from that Scott (and many others) misinterpreted entropy to mean chaos. But an increase in entropy only produces chaos in a CLOSED system. Ilya Prigogine won a Nobel Prize for demonstrating that in OPEN systems, increasing entropy can actually be accompanied by emergent structures, so that order can evolve out of chaos. This is how the universe became orderly, and how biological evolution occurred. Hence, a conventional monetary economy (price system) is NOT necessarily doomed to chaos because of high energy use, so there was no "force majeure" for a Technate.

Many of Scott's specific designs are still quite valid, but one can't legitimately generalize from that to say that his entire approach to social process improvement and innovation is also valid. The philosopher of science Karl Popper, made the point that only "piece-meal social engineering" is acceptable in modern societies. Therefore, Scott's social design is analogous to a perpetual motion machine - it may look good on paper, but it simply cannot be built in reality.

Forecasting The Future

Those who will shape the future of this Continent's industrial and social systems could learn a great deal from Howard Scott, if they will treat his ideas pragmatically. Conceptual pragmatism tells us that ideas are only as good as the value they provide to their users. Scott saw himself in the role of a consulting social engineer, but society has not adopted his advice. Whether or not he would have adjusted to the challenge of the information age we do now know. But the consequences of that technological change is that the computer has displaced the steam engine as the archetypal machine of this new era.

The drawback with The Mathematical Theory of Energy Determinants is that it is so very unidimensional. Since applied science is the humanly contrived conjunction of cause and effect, a combination of Aristotle's "Four Causes" and McLuhan's "Four Effects" can tell us more about the implications and consequences of technology than can Scott's singularly thermodynamic interpretation. Aristotle recognized that every human contrivance needed a Formal Cause (plan), a Material Cause (components), an Efficient Cause (fabrication), and a Final Cause (purpose). McLuhan realized that there are four types of effects from every human contrivance: A Retrieval Effect (conceptual recycling), an Enhancement Effect (functionality improvement), an Obsolescence Effect (passé displacement), and a Reversal Effect (detrimental inversion).

Furthermore, contrary to Scott's ideological claims, radical change is seldom achievable and rarely acceptable, so partial improvement is usually the only feasible choice. We can deconstruct Scott's blueprint, and evaluate each of its components according to its merits. We can then pragmatically choose those elements that do provide real value-added to our quality of life. In human culture, the flow of energy can be controlled by the use of information. Therefore, technological progression does not impose a pre-determined future. McLuhan summed it up this way. "There is no inevitability where there is a willingness to pay attention." Through his example, Howard Scott encouraged us all to be "systems thinkers" and "life long learners", but

these very qualities now reveal that the Technate is an idea whose time has come and gone. As Howard Scott himself observed, "History is indeed ironical!"

Scott called the organization which he created to promote his ideas Technocracy Inc., and it still has a scattering of followers. Some of the Technocrats recently launched an "unofficial" Technocracy WebPage. Examples of Scott's writings can be found there.

- The Scourge of Politics in the Land of Manna **from 1920**
- A Thermodynamic Interpretation of Social Phenomena **from 1933**
- History and Purpose of Technocracy **from 1965**

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